



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 810 056 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
02.12.1998 Bulletin 1998/49

(51) Int. Cl.⁶: B23K 26/12, B29C 65/06

(43) Date of publication A2:
03.12.1997 Bulletin 1997/49

(21) Application number: 97201482.3

(22) Date of filing: 16.05.1997

(84) Designated Contracting States:
DE FR GB SE

(72) Inventor: Colligan, Kevin J.
North Bend WA 98045 (US)

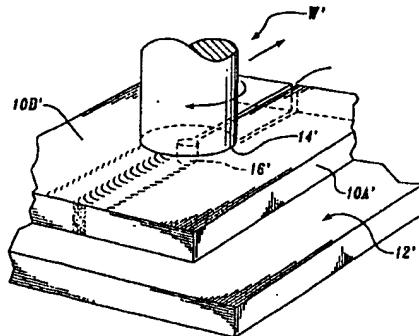
(30) Priority: 31.05.1996 US 655926

(74) Representative:
Land, Addick Adrianus Gosling et al
Arnold & Sledsma,
Advocaten en Octrooigmachtingen,
Sweelinckplein 1
2517 GK Den Haag (NL)

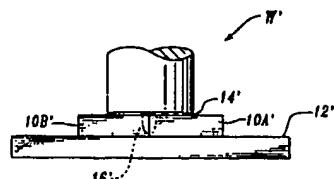
(71) Applicant: THE BOEING COMPANY
Seattle, Washington 98124-2207 (US)

(54) Friction stir welding with simultaneous cooling

(57) A method and apparatus for friction stir welding that produces a weld of significantly reduced surface roughness at significantly higher welding rates, in materials that are difficult to weld, such as non-extrudable aluminum alloys. The method includes cooling the stir welding tool during the welding process, thereby reducing the tendency of softened metal to adhere to the rotating pin and shoulder of the tool. The apparatus includes a tool with internal spaces or an external jacket, through which coolant can be pumped to remove heat and cool the tool during welding operations. In another embodiment, the apparatus includes a device for spraying a coolant onto exterior surfaces of the distal end of the welding tool to thereby remove heat from the tool, and the surrounding workpiece, during welding.



(Prior Art)
Fig. 1A



(Prior Art)
Fig. 1B

EP 0 810 056 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 97 20 1482

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	WO 93 10935 A (WELDING INST) 10 June 1993 -----	1-13	B23K26/12 B29C65/06
D,A	WO 95 26254 A (NORSK HYDRO AS ;MIDLING OLE TERJE (NO); MORLEY EDWARD JAMES (NO);) 5 October 1995 -----	1-13	
A	DAWES C J ET AL: "FRICTION STIR PROCESS WELDS ALUMINUM ALLOYS" 1 March 1996, WELDING JOURNAL INCLUDING: WELDING RESEARCH, VOL. 75, NR. 3, PAGE(S) 41 - 45 XP000587301 * the whole document * -----	1-13	
P,X	GB 2 306 366 A (WELDING INST) 7 May 1997 * page 7, line 1 - line 8 * * page 17, line 25 - line 32 * -----	1,4-6,11	
TECHNICAL FIELDS SEARCHED (Int.Cl.6)			
B23K B29C			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search		Examiner
THE HAGUE	7 October 1998		Haegeman, M
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons S : member of the same patent family, corresponding document			